Energy Efficient Technologies For Government Buildings

- Geothermal Heat Pump
- Virtual Chiller Plant

Second Industry Workshop

Chicago, IL

January 20th, 2006

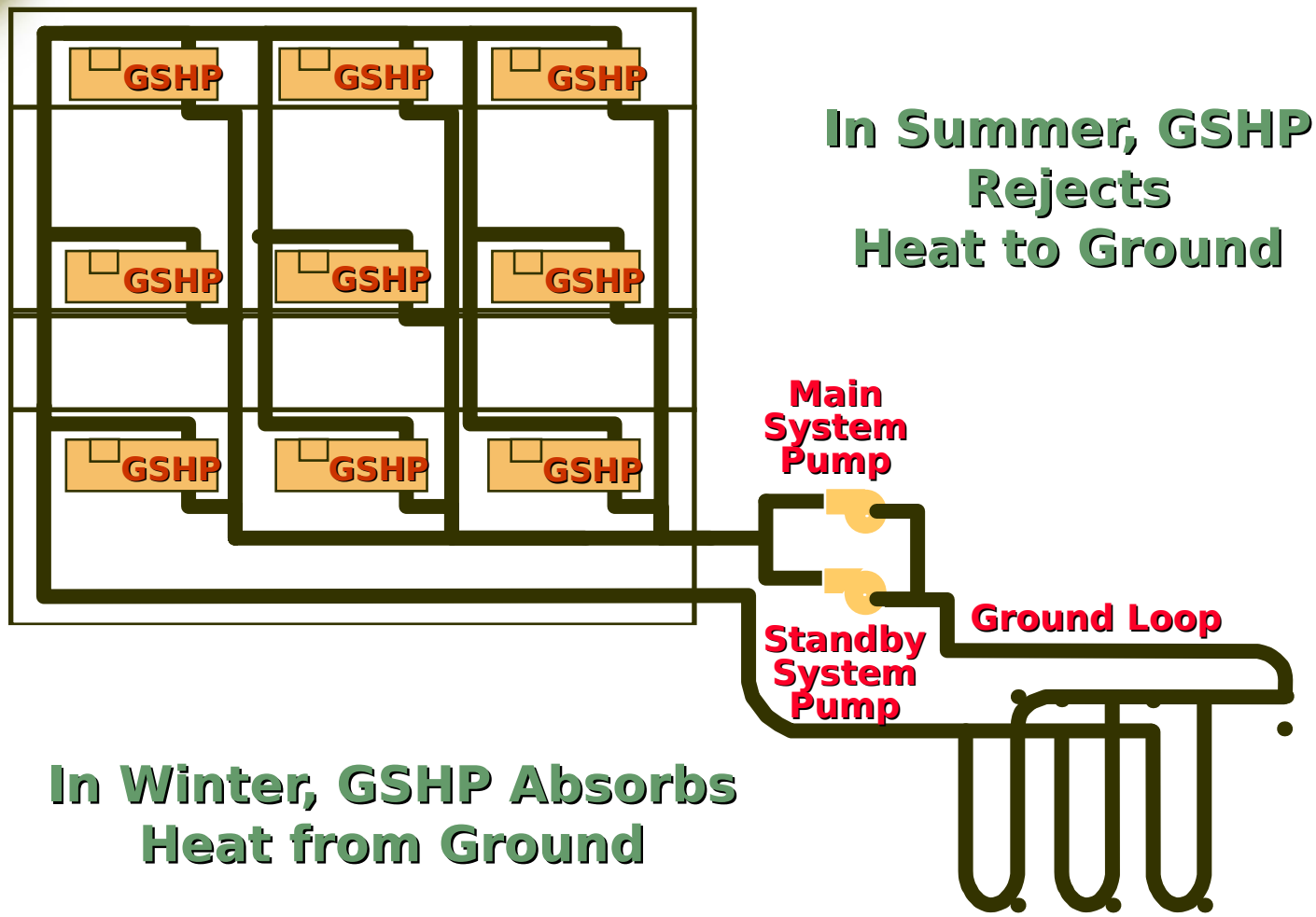
TRANE

BUILDINGS

SAVING THE EARTH. SAVING YOUR MONEY.

INTERNATIONAL BENCHMARK ISO 9002 FOR QUALITY SYSTEMS

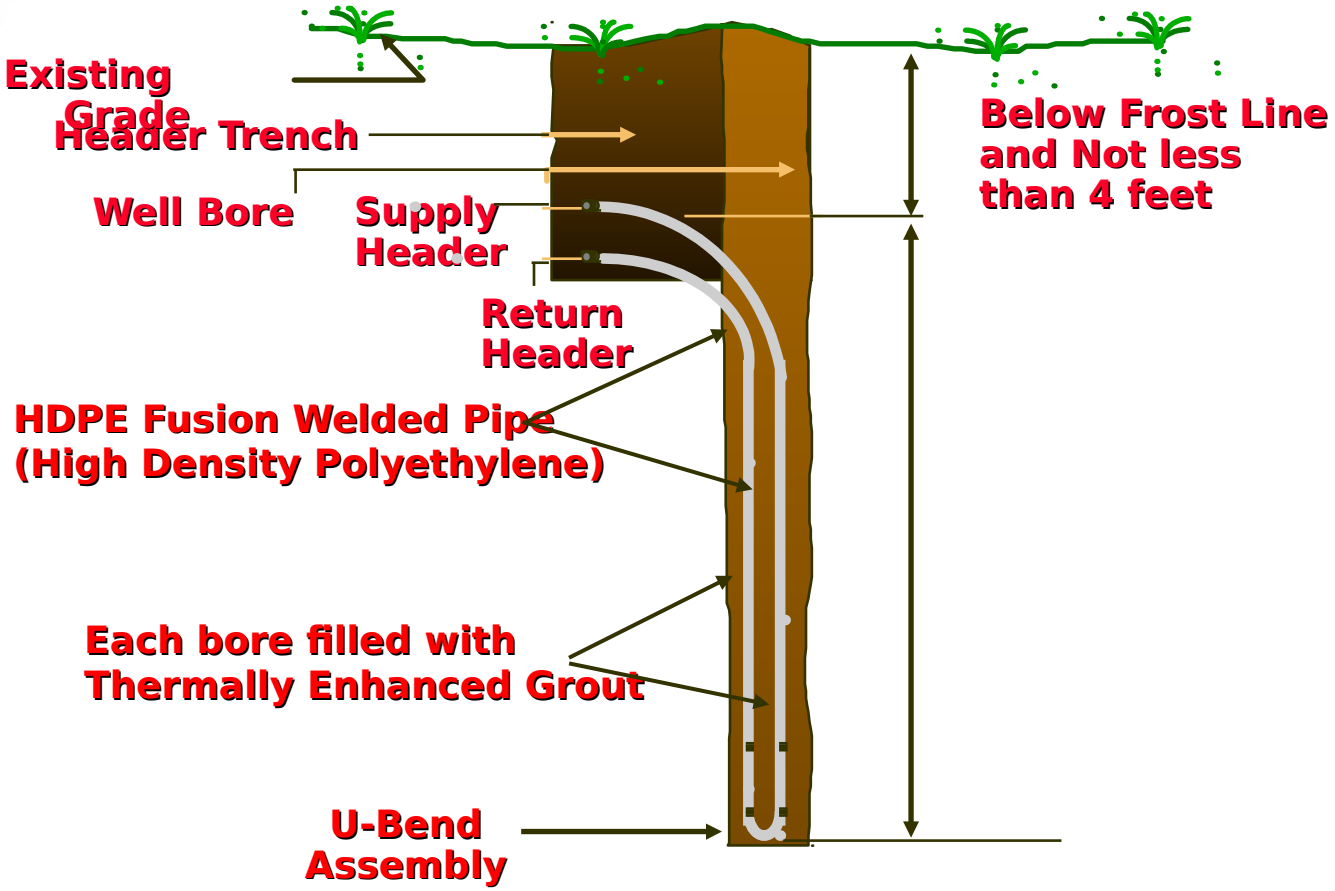
GeoExchange: Transfer of Heat Using Ground Source Heat Pumps



Ground Source Technology

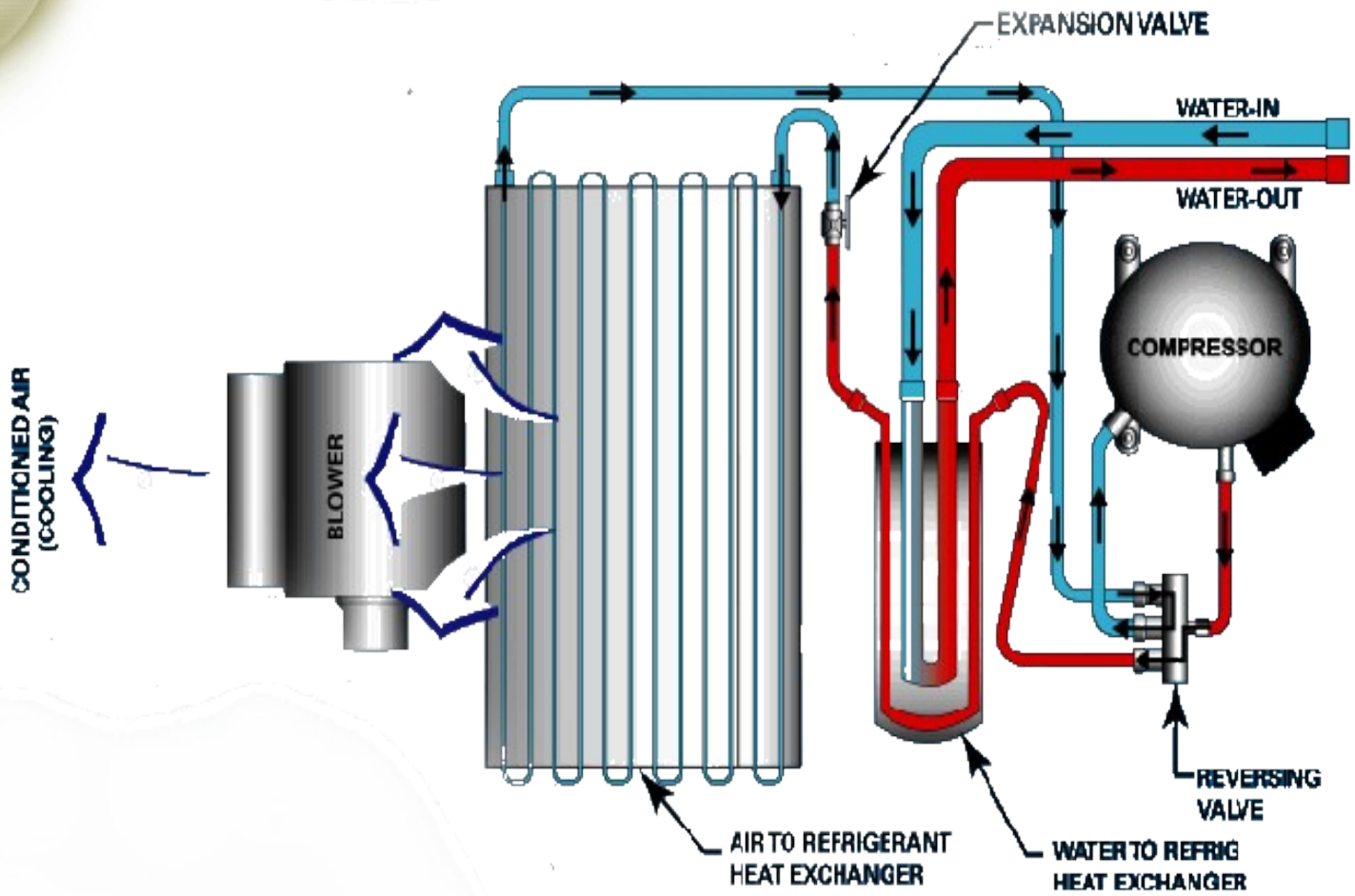
TRANE

Typical GeoExchange Vertical Loop



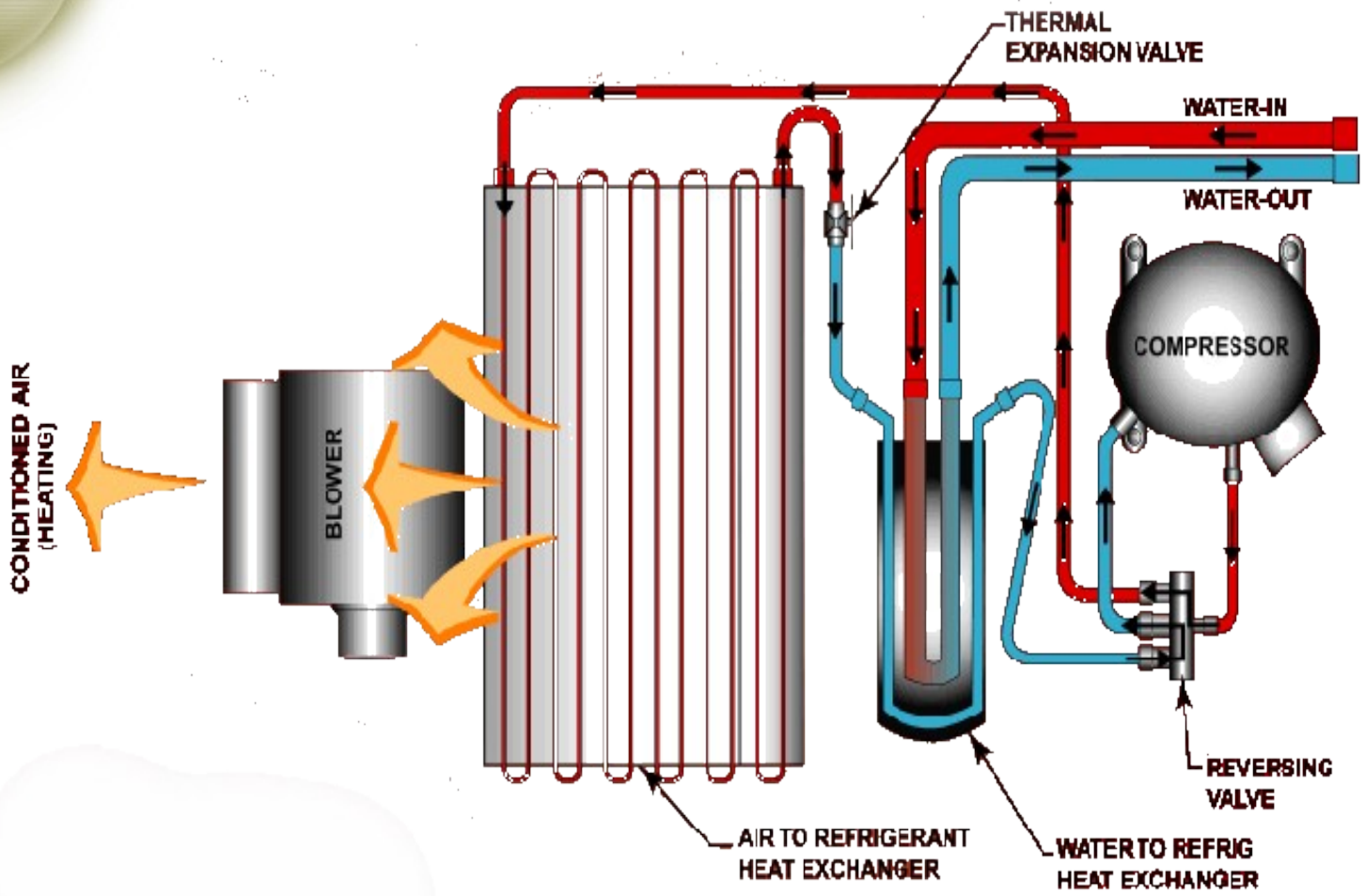
Ground Source Technology

Ground Source Heat Pump
- Cooling Mode -



Ground Source Technology

Ground Source Heat Pump
- Heating Mode -



Ground Source Technology

Sample of Work Setting

Ground Source Technology

Well-Drilling

Header Line Trenching

Sample of Work Setting

Wells: Back-filled with Grout

Headers: Installed 4-6 ft below grade

Ground Source Technology

Benefits of Ground Source Heat Pumps

Benefits of GHP

Design Flexibility: Easy to use for New and Retrofit Situations

- New Construction
- Retrofit Construction
- Reduced equipment room size
- Reuse existing ductwork
- Provide Heating and Cooling without need for a 4-Pipe HVAC System

Low Maintenance:

- Roughly one third the maintenance cost of conventional systems
- The “Workhorse” part of system is underground
- Few Moving Parts; all contained inside building
- No salt air Corrosion

Improved Year Round Comfort:

- Provides heating and cooling any time of year
- Different areas maintained at different temperatures simultaneously
- Heat can be moved from computer rooms to perimeter walls

Benefits of Ground Source Heat Pumps

Reduced Energy Consumption and Corresponding Emi

- By 25% Over Conventional Systems
- One Unit of Electric Energy Moves Three Units of Thermal Energy To or From the Earth

Improved Aesthetics and Reduced Environmental Impa

- No Cooling Towers or Chillers
- All Above Ground Components are Inside the Building
- No Noise
- Reduced Emissions
- No Equipment Around or On Top of Buildings
- No Steam Lines

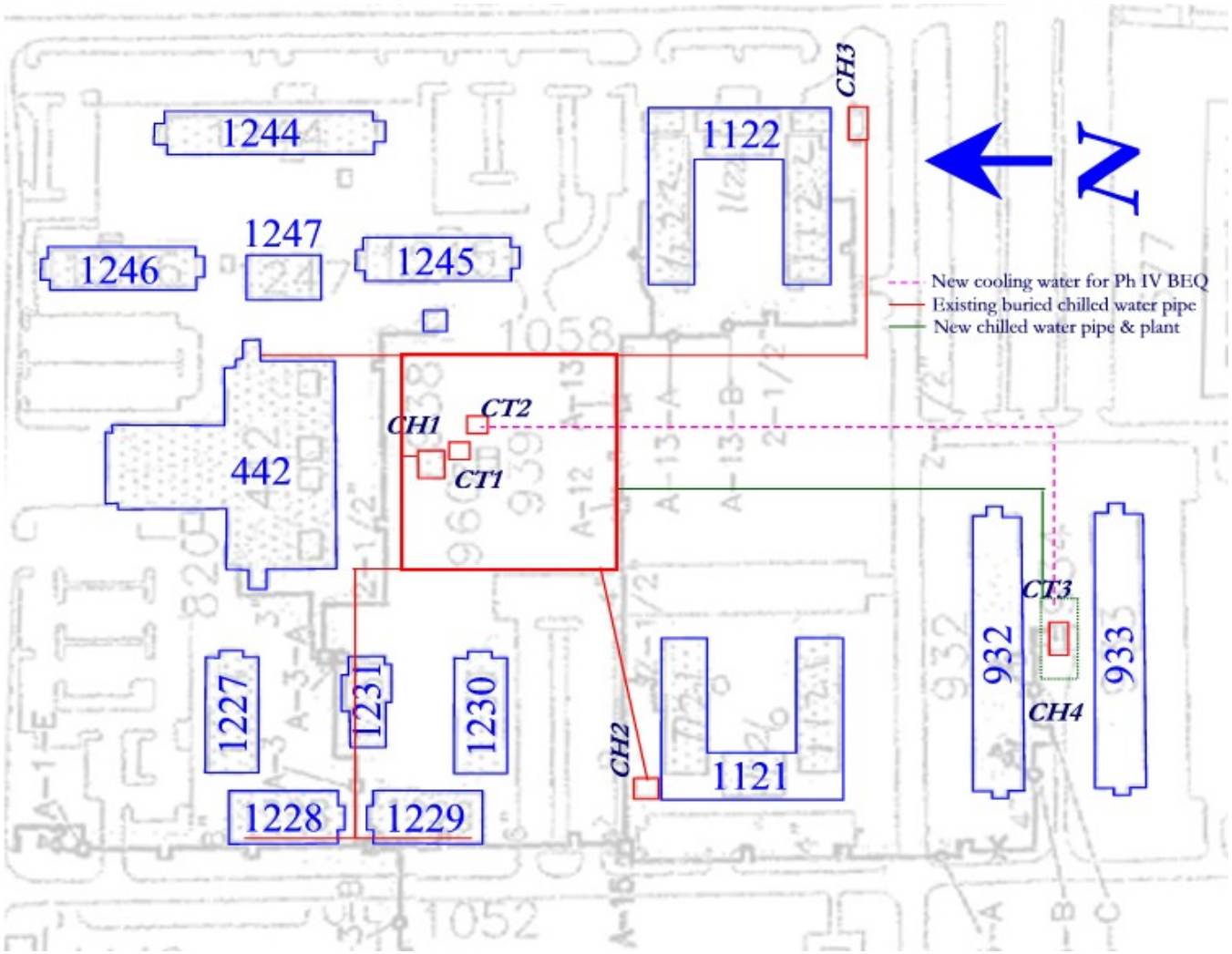
DOD Building Types

- **Building Types**
  - Office Space
  - NCO & Officer's Clubs
  - Chapel
  - BOQ / BEQ
  - MWR: Bowling Alley, Gym, Theater
  - Warehouse, Aircraft Hangar, Maintenance Bay
  - IT and Telecommunications Facilities
  - Radar Facilities
  - Residential

Trane GeoExchange Projects at MCAS Beaufort & NAS Oceana

- Cost and Savings – Simple Payback
  - MCAS Beaufort
    - Project ECM Cost: $ 9 M
    - Project ECM Savings: $ 620 K per Yr
    - Simple Payback: 14.4 Yrs
  - NAS Oceana
    - Project ECM Cost: $ 6.5 M
    - Project ECM Savings: $ 720 K per Yr
    - Simple Payback: 9.0 Yrs

Virtual Chiller Plants



Benefits of GHP

Benefits of Virtual Chiller Plant

Design Flexibility: Easy to use for New and Retrofit Situations

- Operate the distributed chillers as a central plant
- Operate the most efficient chiller during non-peak times
- Cool loop rather than building

Reduced Energy Consumption

Built in Redundancy

If choose to add a new central plant connected to exist
Chillers you can design most optimum plant

- Primary Variable Flow
- Primary/Secondary
- Low chilled water temperatures Earthwise

Trane Virtual Chiller Plant at MCAS Beaufort

- Cost and Savings – Simple Payback
  - MCAS Beaufort
    - Project ECM Cost: $ 4.8 M
    - Project ECM Savings: $ 135 K per Yr
    - Simple Payback: 20 Yrs
    - New chiller plant constructed and moved due to aesthetic reasons which added to the installation costs

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